The method for fabricating Fiber Bragg Grating elements, comprises the steps of: (a) providing a mask having a predetermined pattern and a wafer, wherein a light-guiding channel filled with light-guiding substance is formed on the wafer, and a photoresist layer is formed on the wafer; (b) adjusting the magnification of a photolithography apparatus to a first ~~Mag.~~ magnification and transferring the pattern of the mask onto the photoresist layer to form a first pattern; and (c) removing the light-guiding substance not covered by the photoresist layer so that the first pattern is transferred to the light-guiding channel, thus the light-guiding channel forms a Fiber Bragg Grating element.

J.D.
07/22/05

According to the method of the invention, the mask preferably contains a glass substrate, and the predetermined pattern on the mask is preferably made of Cr.

The method of the invention further comprises adjusting the magnification of the photolithography apparatus to a second ~~Mag.~~ magnification so that the predetermined pattern is transferred to the photoresist layer to form a second pattern, wherein the second ~~Mag.~~ magnification is not equal to the first ~~Mag.~~ magnification, and the first pattern and the second pattern are formed on the light-guiding channel without overlapping one another; wherein the first pattern and the second pattern are simultaneously transferred in step (c) to the light-guiding channel.

J.D.
07/22/05

The method of the invention is also useful in fabricating a planar light circuit (PLC) on a wafer. The PLC comprises: a light-guiding channel, formed on the

Bragg Grating optical element cannot accurately select a specific wavelength due to variation during the fabrication process, it can be overcome by effectively increasing the bandwidth of the Fiber Bragg Grating optical element to meet design requirements. In other words, the planar light circuit, formed by a plurality of Fiber Bragg Grating elements in series, exhibits enlarged bandwidth to accommodate potential variation during the fabrication process.

A detailed description is given in the following embodiments with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention can be more fully understood by reading the subsequent detailed description and examples with references made to the accompanying drawings, wherein:

Fig. 1 is a cross section of a conventional method of fabricating Fiber Bragg Grating elements;

Fig. 2A and 2B are schematic views and cross sections showing the fabrication of the first embodiment;

Fig. 3 illustrates the position of the Fiber Bragg Grating element relative to the wafer according to the first embodiment of the invention;

Figs. 4A and 4B illustrate top views and cross sections of the fabrication process according to the first embodiment of the invention;

JD. 7/22/05

Figs. 5A, 5B and 5C are top views and cross sections of the fabrication process according to the first embodiment of the invention;

J.D. 7/22/05

Figs. 6A, 6B and 6C are top views and cross sections of the fabrication process according to the first embodiment of the invention;

Fig. 7 is a flowchart according to the first embodiment of the invention;

Fig. 8A is a schematic view of the planar light circuit fabricated in the second embodiment of the invention;

Fig. 8B is a graph showing the relation of the gain vs. wavelength according to a conventional Fiber Bragg Grating element;

Fig. 8C is a schematic view of the planar light circuit fabricated in the second embodiment of the invention;

Fig. 9 is a flowchart according to the second embodiment of the invention.

DETAILED DESCRIPTION OF THE INVENTION

Embodiments

1st Embodiment

Fig. 7 illustrates the flowchart according to the first embodiment of the invention.

First, in step S10A, a mask 120, as shown in FIGs. 2A and 2B is provided. A pattern 122 formed with a predetermined pitch A is formed on the mask. The mask 120 is preferably formed on a glass substrate. The pattern 122 is preferably formed by Tin.

Meanwhile, in step S10 B, a wafer 100, shown in FIG. 3 is provided, wherein an area R indicates the position where the Fiber Bragg Grating element is to be formed.

The area R comprises a light-guiding channel 105, filled with light-guiding substance 110. In order to more clearly illustrate the area R, FIGs. 4A and 4B illustrate the top view and cross sections of the area R. Fig. 4B is the cross section of Fig. 4A along the line Y-Y'. For example, wafer 100 is silicon. The light-guiding channel 105 is a trench formed by SiN, wherein the light-guiding substance 110 is SiO.

Next, photoresist is coated onto the area R to form a photoresist layer 140 by a coating machine in step S20.

J.D. 07/22/05

Then, the magnification of a photolithography apparatus is adjusted to a predetermined first ~~Mag~~ magnification in step S30, which is the critical step of the invention where magnification is adjusted to meet various design requirements. In conventional methods, magnification is usually 4 or 5, which means the patterns on the mask, transferred to the wafer, are reduced to 1/4 or 1/5. In other words, magnification of the photolithography apparatus of semiconductor process is fixed, and cannot be changed when adopting conventional methods. As a result, photoresist layers on wafers are continuously exposed and developed one by one without changing magnifications due to stability concerns in the conventional semiconductor manufacturing process. In order to solve this fixed magnification problem, the invention features active modification of the magnification of the photolithography apparatus, in order to meet various design requirements. Consequently, magnification can either be 5 (integer) or with decimals, such as 5.02.

losing focus, or patterns may not be transferred on the photoresist layer. The mirror or mask can also be adjusted to modify the magnifications.

In comparison to the conventional method that cannot fabricate Fiber Bragg Grating elements meeting various design requirements, the invention features a method for fine tuning the magnification of a photolithography apparatus so that Fiber Bragg Grating elements having the required λ_n are fabricated.

2nd Embodiment

This embodiment is an application of the 1st embodiment. A plurality of Fiber Bragg Grating elements fabricated in the 1st embodiment are formed in series, thereby enhancing accuracy and avoiding possible variations during the fabrication process.

FIG. 9 is a flowchart illustrating the process of the 2nd embodiment of the invention. A mask and wafer are provided in step S100A and S100B. A photoresist layer is then formed on the wafer (step S120).

Next, magnification of the photolithography apparatus is adjusted to a first ~~Mag.~~ magnification (step S130). First exposure is performed to the photoresist layer 140 (step S140) without development. Then, if the number of Fiber Bragg Grating elements is insufficient (step S150), the wafer is moved horizontally (step S160), and magnification of the photolithography apparatus is adjusted to a second ~~Mag.~~ magnification (not equal to the first ~~Mag.~~ magnification). A second exposure is then carried out to the photoresist layer 140. Patterns formed by two exposures are then formed on the light-guiding channel, without overlapping

J.D.
07/22/05